(12) UK Patent Application (19) GB (11) 2 261 248 (13) A

(43) Date of A publication 12.05.1993

(21) Application No 9122898.1

(22) Date of filing 29.10.1991

(51) INT CL[5]
E06C 7/08

(52) UK CL (Edition L)
E1S SLS7
B3A A95
E1D DCA DCB D1074 D402 D501

(56) Documents cited
GB 2118237 A GB 1377518 A GB 1362021 A
GB 1232494 A GB 1089761 A GB 0786240 A
GB 0619985 A EP 0267843 A1 EP 0017486 A
US 3342007 A

(58) Field of search
UK CL (Edition K) B3A, E1D, E1S SLS1 SLS3 SLS7
INT CL[5] E06C

(71) Applicant
Abru Aluminium Limited

(Incorporated in the United Kingdom)

Pennygillam Industrial Estate, Launceston, Cornwall, PL15 7ED, United Kingdom

(72) Inventors
David P Oliver
Mark Redsell

(74) Agent and/or Address for Service
Hepworth Lawrence Bryer & Bizley
Lewins House, Lewins Mead,
Bristol, BS1 2NN, United Kingdom

(54) A structural component

(57) A structural component (11) such as a ladder stile, beam, column or strut subject to bending or other stress in use, comprises two generally parallel elongate hollow bodies (13, 14) joined along their length by a web (12). The component may be made by extrusion, by deforming a box section element in its central region, figures 3a–c, or by bending the flanges of channel, I or H-section members.

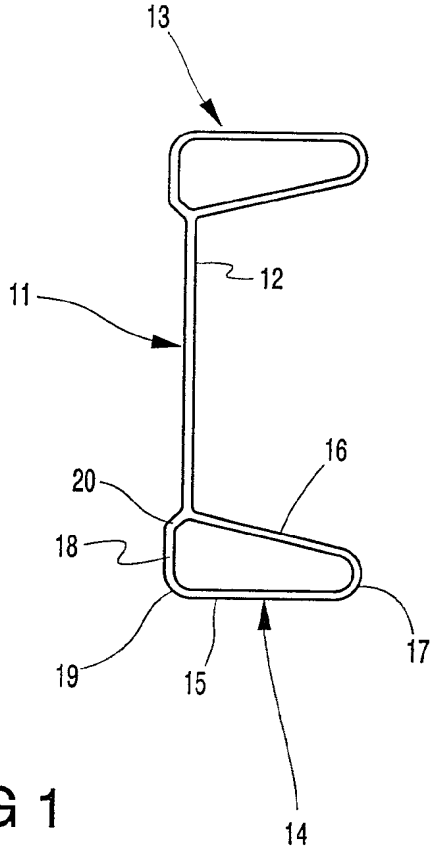

FIG 1

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1990.

GB 2 261 248 A

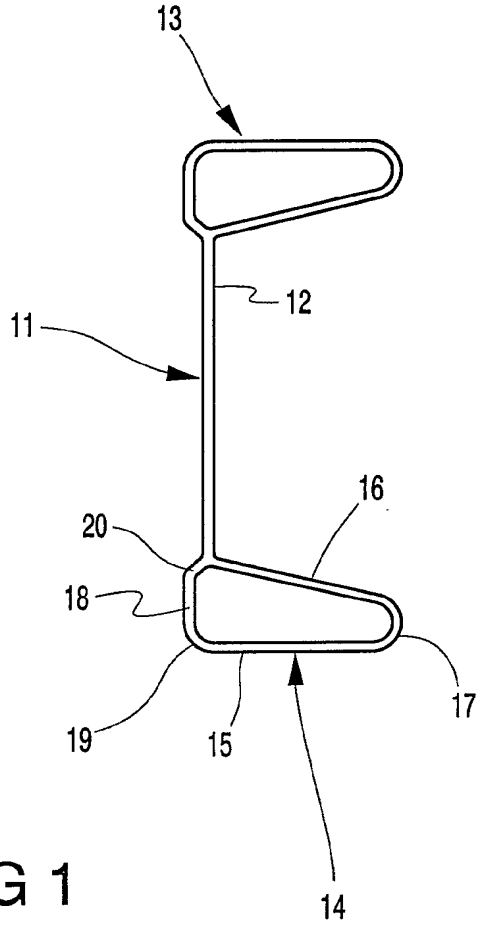

FIG 1

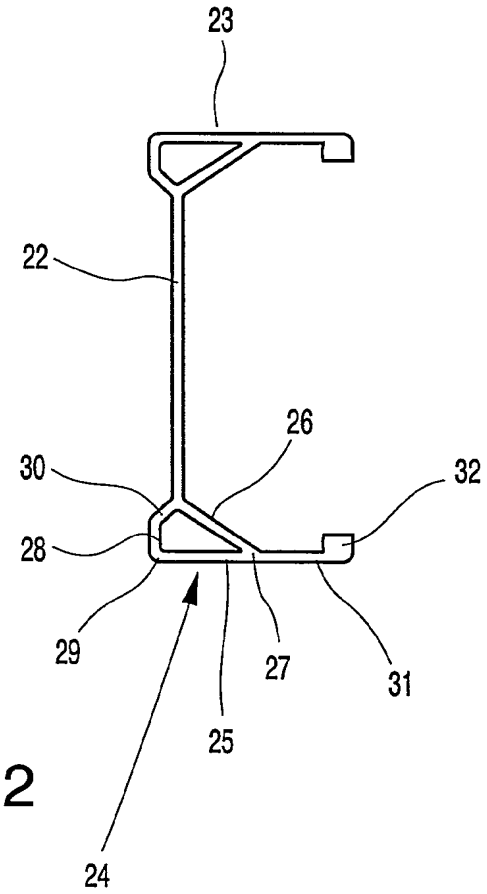

FIG 2

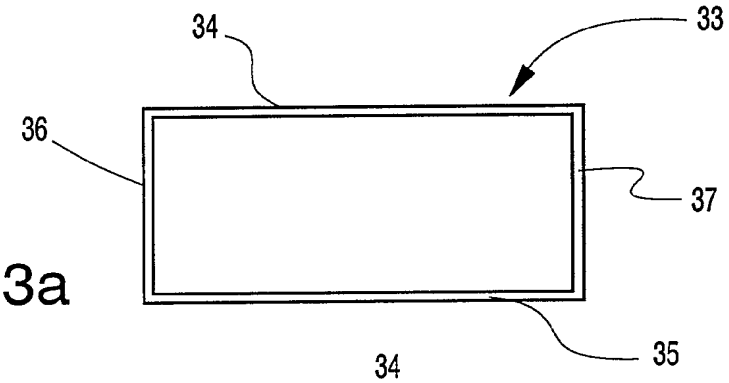

FIG 3a

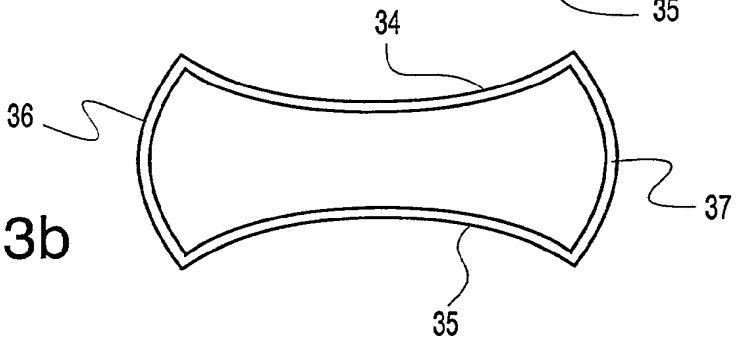

FIG 3b

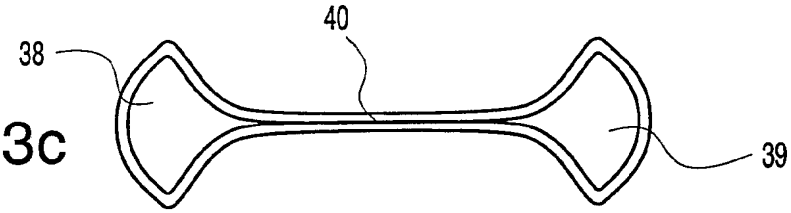

FIG 3c

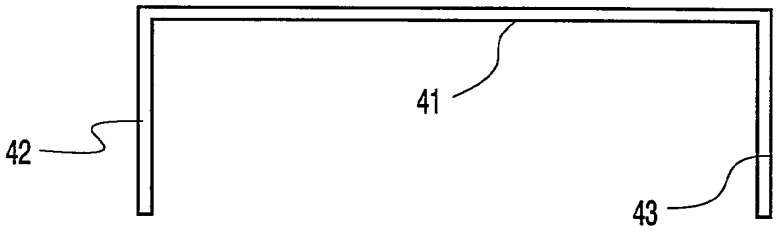

FIG 4a

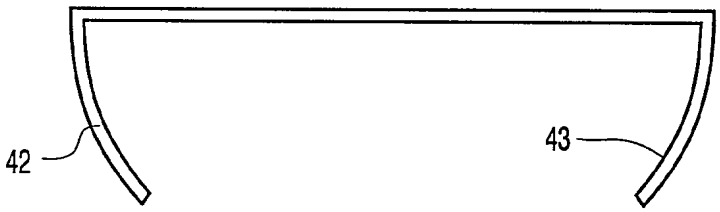

FIG 4b

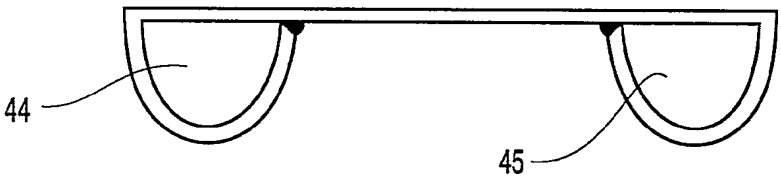

FIG 4c

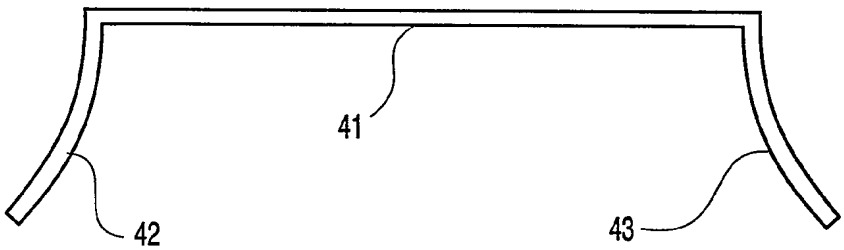

FIG 5a

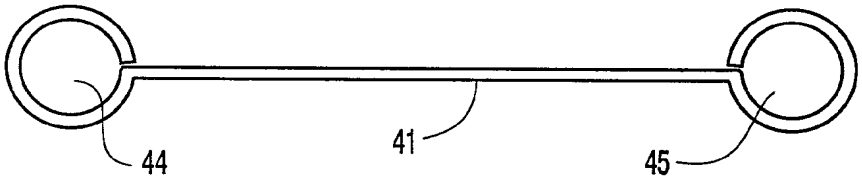

FIG 5b

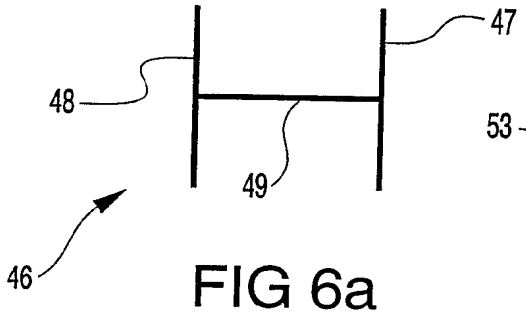

FIG 6a

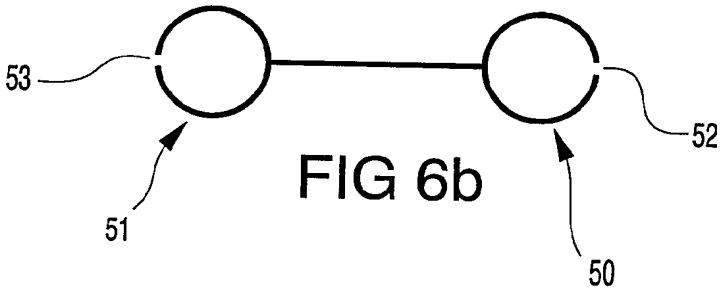

FIG 6b

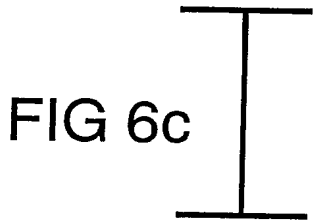

FIG 6c

FIG 6d

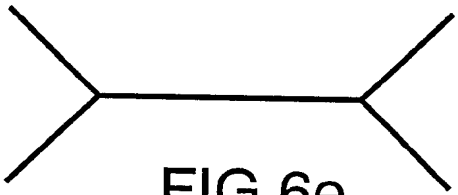

FIG 6e

FIG 6f

FIG 6e

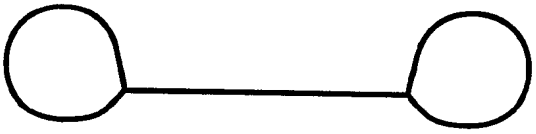

FIG 6h

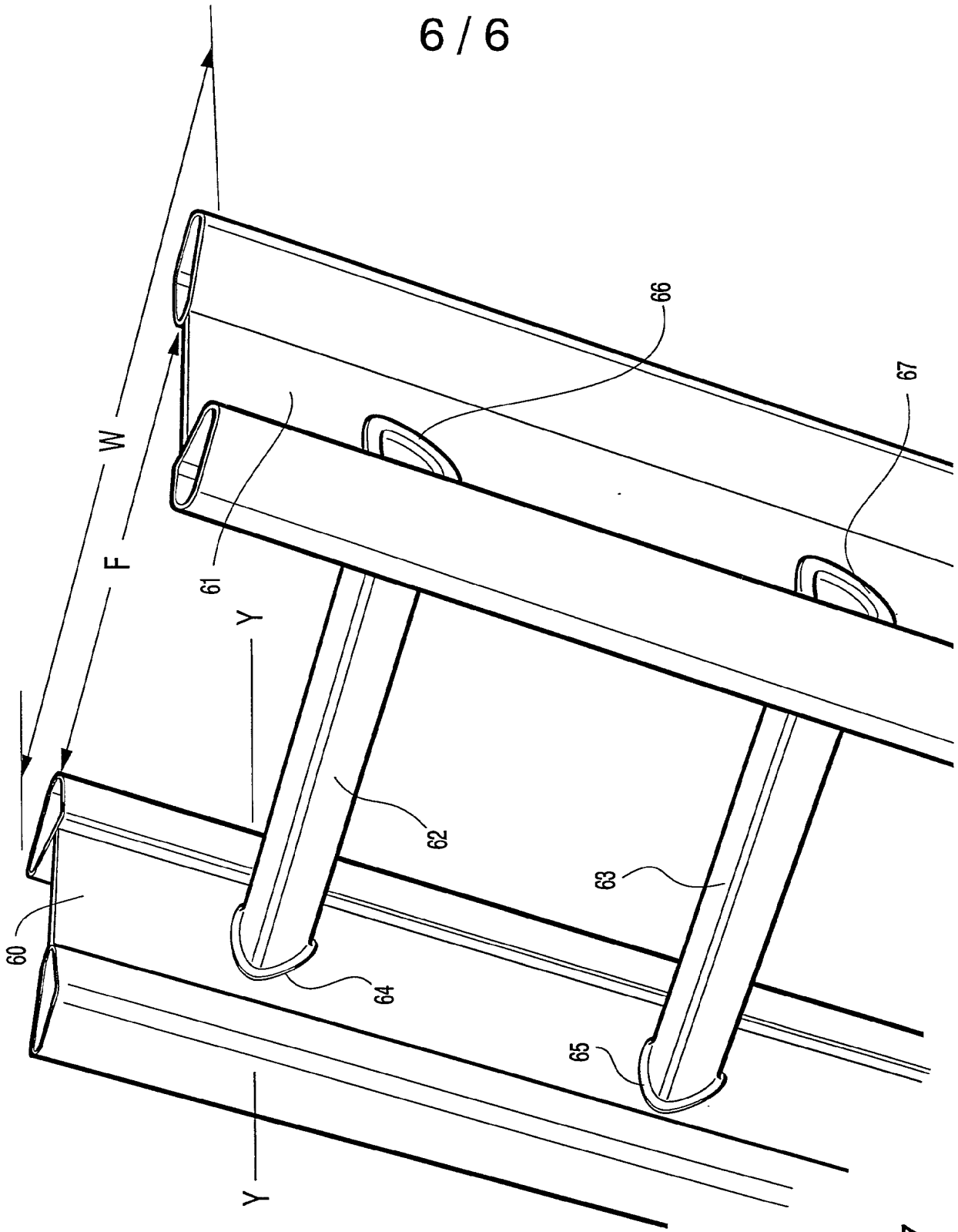

FIG 7

A STRUCTURAL COMPONENT

The present invention relates generally to a structural component suitable for use as a structural member. The structural member of the present invention is particularly suitable for use in structures where it will be subject to bending stress in at least one direction although it may be used in other circumstances.

In the following description particular reference will be made to the application of the structural member of the present invention to ladders, particularly as the ladder stile without prejudice to the generality of the invention. Although it is particularly suitable for use as a ladder stile, the structural member of the present invention is also usable for other functions such as beams, columns, struts or other load bearing members of engineering and civil engineering products and structures.

Conventionally metal ladders are made with a construction utilising an I-section main structural member or stile at each side. The use of I-section member s imposes certain limits, however, on the strength of the ladder, especially against lateral forces, that is forces exerted parallel to the length of the rungs, as well as torsional stresses. Torsional stiffness is, in fact, becoming increasingly important as a criterium for judging the

suitability of a section for use as a ladder stile,because it effects the security of the rung fixing when using the known double clenching technique, by which rungs may be secured to the web of the stile. In this fixing technique, whether the stile is pierced with an opening to receive the end of the rung. The rung is secured in place by two perimetral beads formed successively one on either side of the web to lock the rung firmly against the web. Any tendency for the ladder stile to flex under torsional stress can unacceptably influence the security of fixing of the rungs, especially by loosening the clenching and thereby, over the passage of time, allowing the ladder which is originally a tight rigid structure to become slack and thereby more readily subject to flex laterally.

The objectives of the present invention, therefore, are to provide a structural component capable of resisting bending and other stress in use, which will be particularly suitable for use as a ladder stile. It is important in this respect for the increased strength to be achieved if possible without the use of more material than has hithertofore been used in providing conventional ladder stiles, or at least with a minimum extra material.

According to one aspect of the present invention, therefore, a structural component subject to bending or

other stress in use comprises to generally parallel elongate hollow bodies joined along their length by a web.

Preferably, the two hollow bodies and the web are formed integrally as a unitary element. The said unitary element may be formed by extrusion or other techniques. For example, the said unitary element may be formed by deforming a box-section element such that two opposite walls thereof are brought into contact with one another to form the said web. In this case, of course, the web will have two layers or, alternatively, may be considered as two separate parallel webs. In this case the two webs may be fixed together at one or a plurality of points along their length. Alternatively, the two webs may be joined over the whole of there are in face-to-face contact.

In whatever manner they are formed, the said two hollow bodies may have a symmetrical or an asymmetrical shape about the plan defined by the web. For the particular use as ladder stiles which will be described in more detail below, it is advantageous for the hollow bodies to be asymmetrical about the plan defined by the web for reasons which will be described in more detail below. Even if the bodies are asymmetrical about the plan defined by the web it is preferred that they nevertheless

project to either side of this plan.

In a preferred embodiment of the invention the said two hollow bodies each have at least one generally planar wall portion parallel to but offset from the plane of the web. Likewise, it is preferred that the said two hollow bodies each have at least one major wall portion extending generally transversely of the plane of the web.

Furthermore, the said two hollow bodies may have a cross section or shape which tapers from a broader part adjacent the web to a narrower part space from web.

For use as ladder stiles it is preferred that the section is symmetrical about a median transverse plane passing through the web, in which case the said two hollow bodies will have respective cross sectional shapes which are specular images of one another across the median plane. It is, however, by no means essential that the two hollow bodies should be of the same or similar shape, and in certain specialist applications it is envisaged that the hollow bodies may be dissimilar.

The web thickness may be greater than the wall thickness of the two hollow bodies (regardless of whether the section is made by extrusion, by role forming a box section or any of the other techniques which will be

described herein below.

In addition to the basic form comprising two closed hollow bodies joined by a web, the structural member of the present invention may also include other features. For example, at least one of the said hollow bodies may have the reinforcing flange projecting therefrom. This reinforcing flange may project from the hollow body in a direction other than parallel to the plan of the web although a flange projecting in a direction parallel to the plan of the web may be provided or may also be provided.

Such a reinforcing flange may be of particular value for a member adapted for use as a ladder stile, in which case the reinforcing flange may project from the said hollow body in a direction substantially perpendicular to the plan of the web. Of course, only one of the said hollow bodies may be provided with such a reinforcing flange, or both said hollow bodies may be so provided one or both said hollow bodies may, likewise, further be provided with more than one such projecting flange. This will allow particular stresses to be accommodated when such stresses are foreseen, thereby minimising the mass of material which may be required in the element.

When forming an element with such reinforcing flanges

these may be substantially co-planer with one of the walls of the said hollow body from which it projects or may project in a direction transverse such wall.

The present invention also comprehends a structural member as defined hereinabove formed as a ladder stile.

A ladder stile formed as an embodiment of the present invention may be so shaped that the web is off set towards one side of the said two hollow bodies. This has a number of advantages, especially in simplifying the tools used for fitting the rungs and in reducing the actual length of each rung for a finer effective length.

Accordingly to another aspect of the present invention there is provided a ladder having stiles as defined hereinabove. A ladder formed as an embodiment of the present invention may be provided with rungs formed as hollow metal tubular elements secured to the web by crimping or clinching at the ends thereof.

Various embodiments of the invention will now be more particularly described, by way of example, with reference to the accompanying drawings, in which;

Figure 1 is a cross sectional view taken through an extruded section forming the first embodiment of the

present invention;

Figure 2 is a cross sectional view through a second embodiment of the invention;

Figure 3a, 3b and 3c are schematic sectional views illustrating the formation of a further embodiment of the further invention from the box section element;

Figures 4a, 4b and 4c illustrate schematically the formation of an alternative embodiment from a channel section blank element;

Figure 5a and 5b illustrate schematically an alternative forming method for producing an embodiment of the present invention starting from a channel section such as that illustrated in Figure 4;

Figures 6a, 6b, 6c, 6d, 6e, 6f, 6g and 6h show schematically the formation of areas different embodiments of the present invention starting from I-section, H-section or specially shaped sections;

Figure 7 is a schematic view illustrating a portion of a ladder formed as an embodiment of the present invention utilising the section of figure 1.

Referring now to the drawings, the embodiment shown comprises an integral, unitary extruded section, in this case of aluminium although other materials may be used (especially when utilising other forming techniques as will be described below) generally indicated with the reference numeral 11. The structural member 11 comprises

a planar web portion 12 of indefinite length joined along the entirety of each edge to a respective closed elongate hollow body 13, 14.

The two hollow bodies are specularly symmetrical about a median plan X-X and therefore only a body 14 will be described in detail. This comprises two planar major wall portions 15, 16 which converge towards a connecting bight portion 17 of part-circular shape which is tangential to the plan of the walls 15, 16. From the bight portion 17 the two walls 15, 16 diverge to a transverse edge wall 18 which is joined to the planar major wall 15 by a part-circular section portion 19 which, again, is tangential to the walls 15 and 18 which is joined. Along its opposite edge the wall 18 is joined by a small inclined fillet 20 connecting the wall 18 to the web 12 at the edge thereof. At the junction of the faces of the web 12 with the fillet 20 and the wall 16 these are formed with a smooth radius as is the junction between the face of the wall 16 within the hollow body and the adjacent face, also within the hollow body of the fillet 20.

The thickness of the web 12 is slightly greater than that of the walls 15, 16, 18 and, in specific embodiment illustrated, the web thickness is 1.65mm whilst the wall thickness of the hollow bodies is 1.35mm. These

dimensions are given by way of example only, however, an embodiments having different ratios and different wall thicknesses as well as different overall dimensions may be formed. The structural component section illustrated in Figure 1 is particularly suitable for use as a ladder stile as will be described in more detail below in relation to Figure 7. This embodiment is particularly suitable to be formed by extrusion of metal alloy such as aluminium.

Referring now to Figure 2, a different section embodying the principals of the present invention is illustrated. This is also suitable for use as a ladder stile. In the embodiment of Figure 2 a planar web 22 joins to hollow elongate bodies 23, 24 along each opposite edge. Again, each of the hollow bodies 23, 24 is specularly symmetrical about a median plan Z-Z perpendicular to the plan of the web 22 and extending parallel to the length thereof. Accordingly only the body 24 will be described hereinbelow in detail. This body comprises two planar inclined walls 25, 26 converging along one edge to a junction 27 and spanned at their opposite edge by a transverse wall 28 joined to the planar wall 25 by an arcuate tangential curved section 29. A fillet 30 joins the wall 28 to the web 22. This embodiment differs from the embodiment of Figure 1, however, in that the planar wall 25 has a projection flange portion 31 extending

beyond the junction 27 with the inclined wall 26, and terminating with a transverse rib 32 extending along the length of the flange 31 and projecting towards the hollow body 23. As with the embodiment of Figure 1, this embodiment is particularly suitable for production using extrusion techniques.

A structural member having a web joining to elongate hollow bodies may be formed in other ways, however, and various alternatives as illustrated in Figures 3 to 6. In Figure 3 there is shown a rectangular box section generally indicated 33 (3a) having to parallel sides 34, 35 joined by two parallel sides 36, 37 which are perpendicular to the major sides, 34, 35. Figure 3b shows this box section partially deformed by passing between two appropriately formed rollers to initiate the formation of two opposite hollow bodies 38, 39, and Figure 3c shows the finished shape in which the two walls 34, 35 have been brought together to form a composite central web 40 joining the two hollow bodies 38, 39. These bodies have been shown as symmetrical, segmental bodies although by suitable role-forming techniques bodies of any cross sectional shape may be formed.

Figure 4a illustrates a channel section of malleable metal, for example steel having a base 41 and two opposite parallel transverse flanges 42, 43. Figure 4b

illustrates these flanges partially deformed towards one another to commence the formation of two opposite hollow bodies 44, 45 which are shown completed in figure 4c. The hollow bodies 44, 45 may be joined to the web 41 along the junction lines of the three edges of the deformed flanges 42, 43 for example by welding, to form a strong rigid structure. Figure 5 illustrates an alternative role-forming technique starting from the channel section such as that illustrated in Figure 4, in which the flanges 42, 43 are deformed outwardly away from one another to form the hollow bodies 44, 45.

Figures 6a and 6b show the deformation of an H-section element generally indicated 46 having transverse flanges 47, 48 projecting on both sides of a central web 49. The basic section is illustrated in Figure 6a and the finished structural section illustrated in Figure 6b. The two opposite sides of each flange 47, 48 shown curved round to form a semi-circular (or rather semi-cylindrical) part of a respective hollow body 50, 51. The two free edges of the opposite parts of the flanges 47, 48 may be left butting or may be joined such as by welding along seem lines 52, 53 to form sealed bodies. Similar roll forming operations may be performed to generate the sections shown in figures 6c and 6d; 6e and 6f; 6g and 6h. As will be seen from these drawings, differently shaped finished structural components are

achieved by starting from differently shaped initial sections.

Finally, Figure 7 illustrates a portion of a ladder formed using the structural component of Figure 1 as a stile. In the ladder illustrated in Figure 7 to opposite webs 60, 61 of two identical sections are joined by a plurality of rungs 62, 63 which are fitted into apertures (not shown) pre-formed into the webs 60, 61 and perimetral beads 66, 67 on the "outside" faces of the webs 60,61. As will be appreciated from Figure 7, the assymmetrical shape of the sections forming the stiles of the ladder offers the advantage that by positioning the webs 60, 61 closer to one another for a given overall width W of the ladder it is possible for each of the rungs 62, 63 to be shorter than would be the case if each web 60, 61 was symmetrical within the boundary of the section. This at the same time economises on the material used on the rungs since, as will be appreciated the effective available space for the user's feet is defined by the distance F between the walls 18 of the opposite hollow bodies. At the same time the lobe shape defined by the two converging side walls 15, 16 provides increased rigidity both against flexing in a transverse sense, that is bending about a line Y-Y of Figure 7 as well as increased torsional rigidity of the stile section as a whole thereby increasing the security of the

clenched connection between the rungs 62, 63 and the webs 60, 61.

A further advantage of the asymmetric section for use as a ladder stile lies in the simplification of rung assembling tools which can be shaped such that a simple closing action is sufficient to grip the rung and form the shoulder against which the bead for retaining the rung in position against the web is formed. This simplification also leads to considerable economy as there are no longer required means to make the clamping tools follow a complex path to complete their operation.

The advantages of the structural component as a ladder stile does not reside solely in the increased structural stiffness and other mechanical attributes described above, but also offers an improved aesthetic appearance in that the bight portions 17 joining the planar inclined walls 15, 16 offer an extended rounded surface for the user's hands to grip the ladder whilst climbing, which compares favourably with the rather sharp corners presented by the edges of the transverse flanges of the I-sections hithertofore used for this purpose.

CLAIMS

1. A structural component subject to bending or other stress in use, comprising two generally parallel elongate hollow bodies joined along the length by a web.

2. A structural component as claimed in Claim 1, in which the said two hollow bodies have a cross-sectional shape in which the maximum dimension transverse the plane of the web is greater than the maximum dimension parallel to the plane of the web.

3. A structural component as claimed in Claim 1 or Claim 2, in which the two hollow bodies and the web are formed integrally as a unitary element.

4. A structural component as claimed in Claim 3, in which the said unitary element is formed by extrusion.

5. A structural component as claimed in Claim 3, in which the said unitary element is formed by deforming a box-section element such that two opposite walls thereof are brought into contact with one another to form a web having two layers.

6. A structural component as claimed in any preceding claim, in which the two bodies project to either side of

the plane defined by the web.

7. A structural component as claimed in any preceding Claim, in which the wall thickness of the said two hollow bodies is less than tht of the web.

8. A structural member as claimed in any preceding Claim, in which at least one of the said hollow bodies has a reinforcing flange projecting therefrom.

9. A structural member as claimed in Claim 13, in which the said reinforcing flange projects from the said hollow body in a direction other than parallel to the plane of the web.

10. A structural member as claimed in any preceding claim formed as a ladder stile.

11. A ladder stile as claimed in claim 10, in which the web is offset towards one side of the said two hollow bodies.

12. A ladder having stiles as claimed in claim 10 or claim 11.

Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

Application number
GB 9122898.1

Relevant Technical fields

(i) UK Cl (Edition 1) E1S (SLS1, SLS3, SLS7); E1D; B3A

(ii) Int Cl (Edition 5) E06C

Search Examiner
A H MITCHELL

Databases (see over)

(i) UK Patent Office

(ii)

Date of Search
1 FEBRUARY 1993

Documents considered relevant following a search in respect of claims 1-12

Category (see over)	Identity of document and relevant passages		Relevant to claim(s)
X	GB 2118237 A	(HOLGERSSON) Note the hollow channels 4	1-4, 10-12
X	GB 1377518	(GRILLO) Note the beads 82, 86 Figure 12	1, 3, 4
X	GB 1362021	(RUSCHITZKA) See Figure 5	1-3
X	GB 1232494	(SIDERURGICA) See Figures 10 to 15	1-3, 5, 6
X	GB 1089761	(RACOLE)	1, 10, 12
X	GB 0786240	(A G UNTERNEHMUNGEN) See Figure 4	1, 3
X	GB 0619985	(GOOSEY)	1, 10, 12
X	EP 0017486	(BAILEY) See hollow Sections 12, 12a	1, 3, 10-12
X	EP 0267843 A1	(FERALCO) Note the flange 15	1-4, 6, 7
X	US 3342007	(MERSON) See Figure 1	1-3, 6

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family, corresponding document.

Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).

Published 1993 at The Patent Office, Concept House, Cardiff Road, Newport, Gwent NP9 1RH. Further copies may be obtained from Sales Branch, Unit 6, Nine Mile Point, Cwmfelinfach, Cross Keys, Newport, NP1 7HZ. Printed by Multiplex techniques ltd, St Mary Cray, Kent.